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National Culture, Infrastructure, and Costs: Factors that Lead to the Use of Wireless Technologies

Jon Heales
University of Queensland Business School

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Jon Heales
University of Queensland Business School
j.heales@business.uq.edu.au

ABSTRACT

This research-in-progress paper utilizes the Technology Acceptance Model (TAM) to assess the effects of National Culture, Infrastructure, and Access Costs on the adoption of Wireless Technologies in Australia. The cultural dimensions emanating from the GLOBE project were chosen because of their broad coverage and contemporary nature. Australia is unique in that it has one of the lowest population densities in the world. The provision of wireless technologies is challenging in such an environment, and I believe the model developed in this research will have applicability in other similarly populated countries.

Keywords

Technology Acceptance Model; Cross-Cultural IS Research; IT Adoption; Globe Project; Australia.

INTRODUCTION

There have been many studies using the technology acceptance model (TAM) (Davis, 1989). However, only a few have applied the model outside of North America. Extending the work of McCoy and Polak (2003) who investigated these same factors on Information and Communication Technology (ICT) adoption in Mexico, this research attempts to apply these factors to Wireless Technology adoption in Australia

PRIOR RESEARCH

Technology Acceptance Model

Davis (1989) developed the TAM model to predict acceptance of technology by users. In his work, Davis posits that users develop perceptions about the usefulness and ease-of-use of technologies. These perceptions influence intention to use a particular technology. The TAM model is used to examine how National Culture, Infrastructure, and Access Costs affect the intention to use and usage of wireless technologies in Australia.

National Culture

Culture is a complex notion that is best assessed in terms of multiple dimensions (see Table 1). Hofstede et al (1984) define culture as, “collective programming of the mind” (p. 13). Building on the work of Hofstede and others, the GLOBE project identified 9 dimensions of culture. The GLOBE Project focuses on culture and leadership in 61 countries. Initiated in 1995, it is a multiphase, multi-method project in which investigators examine interrelationships between societal culture, organizational culture, and organizational leadership. Some 150 social scientists and management scholars from 61 cultures are engaged in this long-term programmatic series of cross-cultural leadership studies (House; Javidan; Hanges and Dorfman, 2002). The approach builds on Hofstede’s dimensions, but the methods used, the broadening of the scope of inquiry, and the view taken to cluster countries into cultural clusters mitigates many of the criticisms raised against the use of Hofstede's dimensions, including those of Myers and Tan (2002). Table 1 details all the GLOBE Cultural Dimensions and their sources.

Dimension Sources	GLOBE Dimensions	Variable Name	Definition
Power Distance (Hofstede, 1980)	Power Distance	PD	Degree to which members of an organization or society expect and agree that power should be unequally shared.
Uncertainty Avoidance (Hofstede, 1980)	Uncertainty Avoidance	UA	Extent to which members of an organization or society strive to avoid uncertainty by reliance on social norms, rituals, and bureaucratic practices to alleviate the unpredictability of future events.
Individualism (Hofstede, 1980)	Institutional Collectivism	IC	Degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action.
	Family Collectivism	FC	Reflects the degree to which individuals express pride, loyalty and cohesiveness in their organizations or families.
Kind Heartedness (Hofstede and Bond, 1988)	Humane Orientation	HO	Degree to which individuals in organizations or societies encourage and reward individuals for being fair, altruistic, friendly, generous, caring, and kind to others.
Confucian Dynamism (Hofstede and Bond, 1988)	Performance Orientation	PO	Extent to which an organization or society encourages and rewards group members for performance improvement and excellence. This dimension includes the future oriented component of the dimension called Confucian Dynamism (Hofstede and Bond, 1988).
Past, Present, Future (Kluckholm and Strodbeck, 1961)	Future Orientation	FO	Degree to which individuals in organizations or societies engage in future-oriented behaviors such as planning, investing in the future, and delaying gratification.
Masculinity (Hofstede, 1980)	Gender Egalitarianism	GE	Extent to which an organization or a society minimizes gender role differences and gender discrimination.
	Assertiveness	AS	Degree to which individuals in organizations or societies are assertive, confrontational, and aggressive in social relationships.

Table 1. GLOBE Cultural Dimensions

Wireless Infrastructure

Wireless Technology adoption is dependent on the necessary infrastructure, however, Australia is unique in that it has one of the lowest population densities in the world making the provision of wireless infrastructure technology per head one of the most expensive in the world. As a result, the rollout of infrastructure has been slow, thus where it exists, existing infrastructure facilitates the relationship between intentions to use Wireless Technologies and actual use.

A widely accepted measure of wireless infrastructure is the number of smart handheld devices. IDC estimates the number of smart handheld devices, PDAs and converged phones in Australia will rise from approximately 200,000 in 2002 to over 550,000 in 2006, and the number of notebook computers installed in Australia is expected to grow from 2.5 million to over 4 million in the next five years (Doyle and Martin, 2002).

Access Costs

Access costs to wireless networks varies widely, between US$7.00 per day at premier café's, to free access for students at universities (note, the cost of providing such a service to students is around US$0.21 per usable hour while computer laboratories cost around US$0.50 per usable hour).

PROPOSED STUDY AND MODEL

Figure 1 details the research model, adapted from McCoy and Polak (2003). The focus is on factors that could moderate TAM, including National Culture, Wireless Infrastructure, and Access Cost. TAM is a widely accepted model for predicting technology acceptance that has widespread empirical support. Australia bears many similarities to other Western-style economies such as the USA.

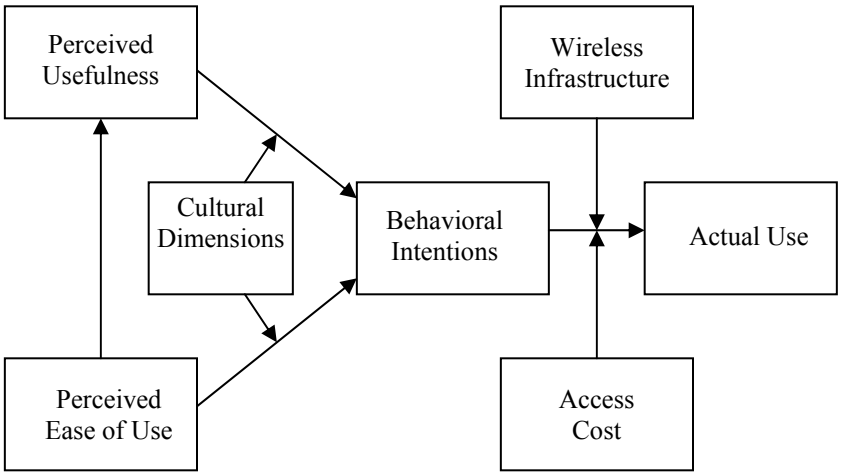

Figure 1. Research Model

Cultural Dimensions

The GLOBE cultural dimensions were examined to determine how each dimension might affect the constructs in the TAM model. I believe only three, UA, PO, and FO will affect individuals' behavioral intentions to adopt. I don't see how changes in PD will affect technology adoption because I am not sure whether those with power would impede adoption of those without power, or whether those with power would adopt to try and gain more power. I see IC as being neutral in that technology would be adopted by all if it is deemed helpful. FC and HO do not affect business relationships. Mobile technologies are not associated with gender or status ruling out GE and AS.

Uncertainty Avoidance

UA is the extent to which a society relies on social norms and procedures to alleviate the unpredictability of future events. Sweden and Switzerland and West Germany (former) score the highest on UA while Russia, Hungary and Bolivia the lowest. Australia has a medium-high UA score.

Png, et al. (2001) found an inverse relationship between UA and the adoption of frame relay technology (an infrastructure component), but adoption of infrastructure components is unrelated to adoption of consumer-based products. In high UA cultures, the relationship between PU and BI would be expected to be stronger because people who aim to reduce uncertainty would most likely perceive a wireless technology as useful, and develop intentions to use it, as the system would allow more access to information that would reduce uncertainty. On the other hand, people scoring low on UA are less interested in reducing uncertainty and would not have that extra incentive to use a system that was useful. The ability to reduce uncertainty with a computer system is highly valued for high UA individuals (Hofstede, 2001). Therefore, the relationship between PU and BI should be significantly stronger for those scoring high on UA, thus:

H1a: PU will influence BI to use wireless technologies more strongly for individuals scoring high on UA than it will for individuals scoring low on UA.

UA is also expected to affect the relationship between PEU and BI. The relationship between PEU and BI is expected to be stronger for those scoring high on UA. This is because a wireless system that is difficult to use would be likely to introduce substantial uncertainty (Hofstede, 1980; Hofstede, 2001; Hofstede et al., 1984). Because cultures scoring low on UA would be more willing to handle uncertainty related to using a computer system, the relationship between PEU and BI is not expected to be as strong.

H1b. PEU will influence BI to use wireless technologies more strongly for individuals scoring high on UA than it will for individuals scoring low on UA.

Performance Orientation

Performance Orientation is the degree to which a society encourages and rewards group members for performance improvement and excellence. Singapore, Hong Kong and New Zealand score the highest, Russia, Argentina and Greece the lowest, whereas Australia has a medium Performance Orientation score.

Cultures that score highly on PO prefer a direct and explicit style of communication and tend to have a sense of urgency (Javidan, 2001). In organizations that reward group members for performance improvement and excellence, it follows that individuals with high PO scores would seek to use technology that they perceive would improve performance. Usage of wireless technology would allow individuals faster and more convenient access to data and information.

H2: PU will influence BI to use wireless technologies more strongly for individuals scoring high on PO than it will for individuals scoring low on PO.

Future Orientation

This dimension refers to the extent to which a society encourages and rewards future-oriented behaviors such as planning and investing in the future. Countries with high future orientation include Singapore, Switzerland and the Netherlands. Overall, Australia is a medium future-oriented culture.

Future Orientation derives from a phenomenon first identified by Kluckhohn and Strodtbeck, 1961. It represents a culture's focus on the past, present or future. A future-oriented culture would evaluate plans in terms of future benefits, and delay gratification. Individuals are likely to be engaged in planning and future investment, and be prepared to delay gratification to (say) invest in wireless technology.

H3: PU will influence BI to use wireless technologies more strongly for individuals scoring high on FO than it will for individuals scoring low on FO.

Wireless infrastructure

Factors, such as Wireless infrastructure and access costs, could prevent useful and easy to use technologies from being used by individuals. The presence of hotspots (wireless access points) is critical to the use of wireless technologies. Thus, wireless infrastructure is expected to moderate the relationship between BI and actual usage.

H4: Wireless Infrastructure will positively moderate the relationship between BI and Actual Use, such that the better the overall Wireless Infrastructure, the higher the level of Actual Use.

Access Costs

While the availability of the wireless devices to the general population can be viewed as a facilitator in the Wireless Technology usage analysis, the general cost levels that potential users have to pay for access to these wireless networks can be considered as inhibitors to actual use. Two cost components are examined, access costs, and capital costs.

H5a. Access Costs will negatively moderate the relationship between BI and Actual Use, such that the higher the individual Access Costs, the lower the level of Actual Use.

In addition to the connection costs, access to wireless networks requires capital investment in wireless equipped notebooks, PDA's or wireless network cards. Capital costs will act as an inhibitor to Actual Use and moderate the relationship between BI and Actual Use.

> *H5b. Capital Costs will negatively moderate the relationship between BI and Actual Use, such that the higher the individual Capital Costs, the lower the level of Actual Use.*

RESEARCH METHOD, PROPOSED ANALYSIS AND EXPECTED RESULTS

This study will utilize a web-based survey instrument to collect data on the constructs in the model. Participants will be invited to participate based on their membership of professional societies in Australia and other countries. In order to test how well the TAM model explains variance in intention to use Wireless Technologies within the Australian sample, regression analysis will be used. For example to test for the moderating effect that Wireless Infrastructure (WI) has on the relationship between Behavioral Intentions (BI) and Actual Use (AU), the following regression equation will be used against the data collected from the web survey:

$$\mathbf{AU} = \alpha + \beta_1\mathbf{BI} + \beta_2\mathbf{WI} + \beta_3\mathbf{WI*BI} + \varepsilon$$

The moderating effect will be shown by the significance of $\beta 3$. In addition, Globe's measures of national culture will be used to investigate the moderating effects of National culture on BI. Primary data will also be collected and used to determine the costs of Wireless Internet access (access and capital costs) and the relative Wireless infrastructure. These two independent variables will also be used in a linear regression model to test their relationship with intentions to use Wireless Technologies.

CONCLUSIONS AND CURRENT STATUS

This research-in-progress research attempts to develop a comprehensive model of Wireless Technologies use in Australia by combining the TAM model with Culture, Wireless infrastructure, and Access Costs. It is expected that culture will moderate the relationship between PU and BI, and PEU and BI. In addition, Wireless infrastructure and access costs will moderate the relationship between BI and actual use. This further contributes to the cultural theoretical foundation called for by others (Ford; Connelly and Meister, 2003; Martinsons and Davison, 2003).

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